

WHAT IS CLAIMED IS:

1 1. A method of generating a synthetic aperture radar (SAR) image
2 from a SAR signal, the SAR signal being indicative of a scene having a multitude
3 of point scatterers and distributed area scatterers, the method comprising:

4 performing a first partial data stabilization to a point operation on the
5 SAR signal to generate a partially stabilized SAR signal;

6 performing an along-track migration operation on the partially
7 stabilized SAR signal to migrate SAR signal support of the scatterer in the scene as
8 a function of along-track location of the scatterer in the scene in order to generate
9 an along-track aligned partially stabilized SAR signal;

10 performing a second partial data stabilization to a point operation on
11 the along-track aligned partially stabilized SAR signal in order to complete the
12 performance of the data stabilization to a point operation on the SAR signal and
13 thereby generate an azimuth formatted SAR signal; and

14 processing the azimuth formatted SAR signal to generate the SAR
15 image.

1 2. The method of claim 1 wherein the step of performing the first
2 partial data stabilization to a point operation comprises:

3 using on the SAR signal a first two-dimensional phase multiplier in
4 order to generate the partially stabilized SAR signal.

1 3. The method of claim 2 wherein the step of performing the along-
2 track migration operation comprises:

3 using on the partially stabilized SAR signal an azimuth fast Fourier
4 transformation (FFT), a second two-dimensional phase multiplier, and an inverse
5 azimuth FFT in order to generate the along-track aligned partially stabilized SAR
6 signal.

1 4. The method of claim 3 wherein the step of performing the second
2 partial data stabilization operation comprises:

3 using on the along-track aligned partially stabilized SAR signal a third
4 two-dimensional phase multiplier in order to generate the azimuth formatted SAR
5 signal.

1 5. The method of claim 1 wherein the SAR signal has an azimuth
2 chirp associated with a center transmitter frequency, wherein the step of performing
3 the first partial data stabilization to a point operation on the SAR signal comprises:

4 removing the azimuth chirp associated with the center transmitter
5 frequency of the SAR signal to generate the partially stabilized SAR signal.

1 6. The method of claim 1 wherein the SAR signal includes a
2 plurality of pulses each having an azimuth chirp associated with a center transmitter
3 frequency and each having a fast-time frequency, wherein the step of performing the
4 first partial data stabilization to a point operation on the SAR signal comprises:

5 performing a pulse-by-pulse phase shift without affecting the fast-time
6 frequency of the pulses of the SAR signal in order to remove from the pulses of the
7 SAR signal the azimuth chirp associated with the center transmitter frequency.

1 7. The method of claim 1 wherein the SAR signal has an azimuth
2 chirp associated with a center transmitter frequency, the azimuth chirp having a
3 quadratic component and a non-quadratic component, wherein the step of
4 performing the first partial data stabilization to a point operation on the SAR signal
5 comprises:

6 removing the quadratic component of the azimuth chirp associated
7 with the center transmitter frequency of the SAR signal to generate the partially
8 stabilized SAR signal.

1 8. The method of claim 1 wherein the SAR signal includes a
2 plurality of pulses each having an azimuth chirp associated with a center transmitter
3 frequency, the azimuth chirp having a quadratic component and a non-quadratic
4 component, each pulse having a fast-time frequency, wherein the step of performing
5 the first partial data stabilization to a point operation on the SAR signal comprises:

6 performing a pulse-by-pulse phase shift and adjusting the fast-time
 7 frequency of the pulses of the SAR signal in order to remove from the pulses of the
 8 SAR signal the quadratic component of the azimuth chirp associated with the center
 9 transmitter frequency.

1 9. The method of claim 1 wherein the step of performing the along-
2 track migration operation on the partially stabilized SAR signal to migrate SAR
3 signal support of the scatterer in the scene as a function of along-track location of
4 the scatterer in the scene in order to generate an along-track aligned partially
5 stabilized SAR signal comprises:

6 performing an azimuth Fourier transform of the partially stabilized
7 SAR signal to reach a nominal azimuth image domain of the partially stabilized SAR
8 signal;

9 multiplying the nominal azimuth image domain of the partially
10 stabilized SAR signal by an azimuth quadratic phase function; and

11 performing an azimuth inverse Fourier transform of the nominal
12 azimuth image domain of the partially stabilized SAR signal in order to migrate SAR
13 signal support of the scatterer in the scene as a function of along-track location of
14 the scatterer in the scene to generate the along-track aligned partially stabilized SAR
15 signal.

10. The method of claim 1 wherein:

the first partial data stabilization to a point operation is a slow-time data stabilization component of the data stabilization to a point operation.

11. The method of claim 10 wherein:

the second partial data stabilization to a point operation is a fast-time data stabilization component of the data stabilization to a point operation.

1 13. The method of claim 1 wherein:
2 the SAR signal is a strip map SAR signal.

1 14. The method of claim 1 wherein:
2 the SAR signal is a scan mode SAR signal.

1 15. The method of claim 1 wherein the step of processing the
2 azimuth formatted SAR signal to generate the SAR image comprises:
3 performing a range interpolation operation on the azimuth formatted
4 SAR signal to generate an azimuth and range formatted SAR signal; and
5 performing on the azimuth and range formatted SAR signal an
6 azimuth and range fast Fourier transform in order to generate the SAR image.

1 16. The method of claim 15 wherein:
2 the range interpolation operation includes a Stolt interpolation
3 operation.

1 17. The method of claim 15 further comprising:
2 performing an azimuth scaling operation on the azimuth formatted
3 SAR signal prior to the performance of the range interpolation operation.

1 18. The method of claim 1 wherein the step of processing the
2 azimuth formatted SAR signal to generate the SAR image comprises:
3 performing on the azimuth formatted SAR signal, in order, a range
4 fast Fourier transform, a two-dimensional phase multiply, and an azimuth fast
5 Fourier transform in order to generate the SAR image.

1 19. The method of claim 1 wherein the step of processing the
2 azimuth formatted SAR signal to generate the SAR image comprises:
3 performing a polar format algorithm range interpolation operation on
4 the azimuth formatted SAR signal in order to generate the SAR image.

1 20. The method of claim 1 wherein the step of processing the
2 azimuth formatted SAR signal to generate the SAR image comprises:

3 performing a Stolt interpolation and an azimuth and range fast
4 Fourier transform on the azimuth formatted SAR signal in order to generate the
5 SAR image.

1 21. A method of generating a synthetic aperture radar (SAR) image
2 from a SAR signal, the method comprising:

3 performing a first partial data stabilization to a point operation on the
4 SAR signal to generate a partially stabilized SAR signal;

5 performing an along-track migration operation on the partially
6 stabilized SAR signal to generate an along-track aligned partially stabilized SAR
7 signal;

8 performing a second partial data stabilization to a point operation on
9 the along-track aligned partially stabilized SAR signal in order to complete the
10 performance of the data stabilization to a point operation on the SAR signal and
11 thereby generate an azimuth formatted SAR signal; and

12 processing the azimuth formatted SAR signal to generate the SAR
13 image.